

**AIR CLEANER WITH REDUCED
RESTRICTION PRECLEANER**

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AIR CLEANER WITH REDUCED RESTRICTION PRECLEANER

BACKGROUND AND SUMMARY

5 [001] The invention relates to air cleaners, and more particularly to air cleaners having a tangential inlet and a precleaner.

 [002] Air cleaners with a tangential inlet and a precleaner are known in the prior art. Such air cleaners typically have a cylindrical housing and provide two stage cleaning, namely a precleaner provided by flow from the tangential inlet along a spiral path, and a second stage provided by radial inward flow through an annular filter element. The precleaner is typically provided by an annular sleeve circumscribing the annular filter element and spaced radially inwardly of the interior surface of the cylindrical sidewall of the housing by a radial gap defining an annular flow channel between the sleeve and the interior surface of the cylindrical housing sidewall. A ramp in the channel may direct air flow along a helical pattern. The sleeve also helps to locate and center the annular filter element within the housing. While the sleeve provides the noted desirable functions, it also contributes to restriction of the air flow as it enters the housing, which restriction is undesirable.

 [003] The present invention addresses the noted restriction disadvantage, and provides a sleeve which desirably facilitates the noted helical air flow pattern for precleaning and also facilitates location and centering of the annular filter element within the housing, and which reduces entry restriction to air flow suffered by prior sleeves.

BRIEF DESCRIPTION OF THE DRAWING

Prior Art

[004] Fig. 1 is an isometric view of an air cleaner known in the prior art.

[005] Fig. 2 is an exploded perspective view of the air cleaner of Fig. 1.

[006] Fig. 3 is a sectional view taken along line 3-3 of Fig. 1

[007] Fig. 4 is an elevation view of the inlet of the air cleaner of Figs. 1-3.

[0008] Fig. 5 is a perspective view partially cutaway of a portion of the air cleaner of Fig. 1.

Present Invention

5 [0009] Fig. 6 is a view like Fig. 3 and shows an embodiment of the present invention.

[0010] Fig. 7 is a view like Fig. 4 and shows the embodiment of the present invention illustrated in Fig. 6.

10 [0011] Fig. 8 is a view like Fig. 5 and shows the embodiment of the present invention illustrated in Figs. 6 and 7.

[0012] Fig. 9 is a view like Fig. 7 and shows another embodiment of the present invention.

[0013] Fig. 10 is a sectional view taken along line 10-10 of Fig. 9.

15 [0014] Fig. 11 is a view like Fig. 8 and shows the embodiment of the present invention illustrated in Figs. 9 and 10.

[0015] Fig. 12 is a view of the cylindrical sleeve and air flow channel of the embodiment of Figs. 9-11 unrolled and laid out in a flat profile view.

DETAILED DESCRIPTION

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Prior Art

[0016] Fig. 1 shows an air cleaner 20 including a cylindrical housing 22 extending axially along an axis 24 and having a tangential inlet 26 and having an outlet 28. An annular filter element 30, Figs. 2, 3, in housing 22 has a dirty side 32 receiving dirty air from inlet 26 and having a clean side 34 delivering clean filtered
25 air to outlet 28. Air entering housing 22 through tangential inlet 26 as shown at arrow 25 flows along an interior surface 36 of housing 22 in a helical spiral pattern 38 about axis 24, and flows radially inwardly through annular filter element 30 into the latter's hollow interior 40 and then flows axially through outlet 28 as shown at arrow 42. Housing 22 is typically a two-piece plastic assembly provided by upper housing

section 44 and lower housing section 46 joined by a twist and lock structure 48, for example as shown in U.S. Patent 6,402,798, incorporated herein by reference. Lower housing section 46 may have a purge valve 50 for periodically discharging collected particulate due to the precleaning provided by the centrifugal separation afforded by helical pattern 38, as is known.

[0017] An annular shielding sleeve 52 is integrally formed as part of the upper housing section 44 and circumscribes annular filter element 30 and is spaced radially inwardly of interior surface 36 of the sidewall of the housing by a radial gap 54 defining an annular flow channel between sleeve 52 and interior surface 36 of the sidewall of the housing. Filter element 30 has upper and lower axial ends covered by respective upper and lower axial end caps 56 and 58, Fig. 2, which end caps may form axial and/or radial seals with respective upper and lower housing sections 44 and 46, all as is known. Upper end cap 56 is at tangential inlet 26 and has an axial height 60, Figs. 2, 3. Tangential inlet 26 has an axial height 62 greater than axial height 60 of end cap 56. Sleeve 52 has an axial height 64 greater than axial height 62 of tangential inlet 26.

[0018] Housing 22 at upper section 44 has a ramp 66 in channel 54 directing air flow along the noted helical pattern 38. Ramp 66 has a leading end 68 and has a trailing end 70. The ramp has a minimum axial height at leading end 68, and has a maximum axial height at trailing end 70. The axial height 64 of sleeve 52 is greater than the maximum axial height of ramp 66 at trailing end 70. The lower axial end 72 of sleeve 52 is viewable in Fig. 3, and is shown in dashed line in Figs. 1, 4, 5.

Present Invention

[0019] Figs. 6-12 illustrate the present invention and use like reference numerals from above where appropriate to facilitate understanding.

[0020] In Fig. 6, annular shielding sleeve 102 circumscribes annular filter element 30 and is spaced radially inwardly of interior surface 36 of the cylindrical sidewall of housing 22 by a radial gap 104 defining an annular flow channel between

sleeve 102 and interior surface 36 of the sidewall of the housing. Sleeve 102 has an axial height 106 greater than or equal to axial height 60 of end cap 56 and less than axial height 62 of tangential inlet 26. This reduces the restriction to incoming air flow through tangential inlet 26 at arrow 25.

5 [0021] Axial height 106 of sleeve 102 is less than the maximum axial height of ramp 66 at trailing end 70. The lower axial end 108 of sleeve 102 is shown in Figs. 6 and 8, and is shown at solid line in the right portion of Fig. 7 and dashed line in the left portion of Fig. 7. Ramp 66 has a first segment 110 extending circumferentially and axially along sleeve 102 from leading end 68 of the ramp to an intermediate
10 portion 112 of the ramp. Ramp 66 has a second segment 114 extending circumferentially and axially beyond sleeve 102 at lower edge 108 from intermediate portion 112 of the ramp to trailing end 70 of the ramp. Intermediate portion 112 of ramp 66 has an axial height 116, Fig. 7, equal to axial height 106 of sleeve 102. The entire circumferential length of second segment 114 of ramp 66 from intermediate
15 portion 112 to trailing end 70 has an axial height greater than axial height 106 of sleeve 102.

 [0022] Figs. 9-12 show a further and preferred embodiment of the present invention and use like reference numerals from above where appropriate to facilitate understanding. In Figs. 9-12, sleeve 102 is replaced by a sleeve 132 having an axial
20 height tapered at 134 along a portion of its circumference at a location aligned with tangential inlet 26, such that incoming air at 25 through tangential inlet 26 does not initially encounter a full axial height sleeve, as at 52 in Figs. 1-5, and preferably not even a partial axial height sleeve as at 102 in Figs. 6-8, but instead encounters a tapered sleeve of increasing axial height from lowest axial height at 136 to highest
25 axial height at 138, whereby to reduce initial flow restriction at air inflow 25.

 [0023] Tapered portion 134 of sleeve 132 has a leading end at 136 and a trailing end at 138. Annular flow channel 140 formed by the radial gap between annular filter element 30 and interior surface 36 of the cylindrical sidewall of the housing has a first circumferential section 142 of increasing axial depth to air flow

therealong from leading end 136 of tapered portion 134 of sleeve 132 to trailing end 138 of tapered portion 134 of sleeve 132. The channel has a second circumferential section 144 directing air flow therealong from trailing end 138 of tapered portion 134 of sleeve 132. Ramp 66 in channel 140 directs air flow along helical pattern 146.

5 Circumferential section 144 of channel 140 directs air flow therealong from trailing end 138 of tapered portion 134 of sleeve 132 to leading end 68 of ramp 66. Channel 140 has a third circumferential section 148 directing air flow therealong from leading end 68 of ramp 66. Third circumferential section 148 of channel 140 has a decreasing axial depth to air flow therealong. Air flow entering tangential inlet 26 encounters
10 increasing axial channel depth along first circumferential section 142 of channel 140 and then is directed through second circumferential section 144 of channel 140 and then encounters decreasing axial channel depth along third circumferential section 148 of channel 140.

 [0024] Tangential inlet 26 is axially between leading end 136 of tapered
15 portion 134 of sleeve 132 and trailing end 70 of ramp 66 such that leading end 136 of tapered portion 134 of sleeve 132 and trailing end 70 of ramp 66 are on axially distally opposite sides of tangential inlet 26. Trailing end 138 of tapered portion 134 of sleeve 132 and leading end 68 of ramp 66 are on circumferentially distally opposite sides of tangential inlet 26. Axial height 150, Fig. 10, of sleeve 132 at trailing end
20 138 of tapered portion 134 of the sleeve, which in the preferred embodiment is the same as axial height 106 of sleeve 102, Fig. 6, is less than the axial height of ramp 66 at trailing end 70. Ramp 66 has the noted first segment 110 extending circumferentially axially along sleeve 132 from leading end 68 of the ramp to intermediate portion 112 of the ramp, and the ramp has the noted second segment 114
25 extending circumferentially and axially beyond sleeve 132 at lower end 133 from intermediate portion 112 of the ramp to trailing end 70 of the ramp. The axial height of sleeve 132 at trailing end 138 of tapered portion 134 of the sleeve is less than the axial height 62 of tangential inlet 26.

 [0025] It is recognized that various equivalents, alternatives and

modifications are possible within the scope of the appended claims.